HALF PLAN — HALF HORIZONTAL SECTION

FLOW

℄ STRUCTURE

10"

#4-F BARS AT ABT. 14" 14" CTS.

#4-F BARS AT 14" CTS.

#5-E BARS ①

2-#4-F BARS

#4-F BARS

#5-G BARS (SPACED SAME AS B2 BARS)

J5 BARS ③

2-#7-J1 BARS

#5-R1 & R2 BARS AT 12" CTS.

#8-D1 BARS

2-#4-F BARS

A3 BARS (SAME SIZE AND SPACING AS A2 BARS)

A2 BAR SPACE

#4-F BARS AT ABT. 14" CTS.

#4-F BARS AT ABT. 14" CTS.

2-#4-F BARS ④

(✱✱)

#4-F BARS

#4-F BARS AT ABT. 14" CTS. ⑤

A1 BARS

J3 BARS

SEE NOTE ② (✱✱✱)

J4 BARS

#5-B2 BARS

A2 BARS

A2 SPACING

#4-F BARS AT ABT. 14" CTS.

#4-F BARS AT ABT. 14" CTS.

#4-F BARS AT ABT. 14" CTS. ⑤

2-#4-F BARS

#4-F BARS

2-#4-F BARS ④

#8-D1 BARS

B

2-#7-J1 BARS

#5-R3 BARS AT 12" CTS.

#4-F BARS

J5 BARS ③

#5-G BARS (SPACED SAME AS B2 BARS)

2-#4-F BARS

#4-F BARS

10"

12"

#4-F BARS AT ABT. 14" CTS.

#5-E BARS ①

SECTION A-A

20"
12" 12"
(TYP.)

#5-R2 BARS AT 12" CTS.

TOP SLAB

F BARS

6"

5"

5"

#8-D1 BARS

#5-R1 BARS AT 12" CTS.

APPROX. 1/3 WALL THICKNESS

2"

CONST. JT.

¼"

DETAIL OF KEYED CONST. JT.

¼"   1"

CONST. JT.

1"

BOTTOM SLAB

APPROX. 1/3 WALL THICKNESS

DETAIL OF TRANSVERSE JOINT THRU BARREL OF CULVERT

FILTER CLOTH

5/16"

5/16" PREFORMED FIBER EXPANSION JOINT MATERIAL

½" (TYP.)

½" (Typ.)

EXPOSED SURFACE

SECTION B-B

20"

#5-R3 BARS AT 12" CTS.

F BARS

6"

#8-D1 BARS

GENERAL NOTES:

ALL DIMENSIONS SHOWN ARE IN INCH UNLESS OTHERWISE NOTED.

FOR DIMENSIONS AND SIZE AND SPACING OF REINFORCING STEEL, SEE STANDARD SHEET 703.15.

LAP ALL LONGITUDINAL BARS A MINIMUM OF 23" AT SPLICES.

MINIMUM CLEARANCE TO REINFORCING STEEL SHALL BE 1-1/2" UNLESS OTHERWISE SHOWN.

PREFORMED FIBER EXPANSION JOINT MATERIAL SHALL BE SECURELY STITCHED TO ONE FACE OF THE CONCRETE WITH NO. 10 GAGE COPPER WIRE OR NO. 12 GAGE SOFT DRAWN GALVANIZED STEEL WIRE.

BEVELED HEADWALL TO BE LOCATED AT UPSTREAM END.

A FILTER CLOTH 3 FEET IN WIDTH AND DOUBLE THICKNESS SHALL BE APPLIED TO ALL TRANSVERSE JOINTS IN THE TOP SLAB AND SIDEWALLS. THE MATERIAL SHALL BE CENTERED ON THE JOINT AND THE EDGES SEALED WITH A MASTIC OR WITH TWO SIDED TAPE. THE FILTER CLOTH SHALL BE A GEOTEXTILE MEETING SEC 1011 FOR SUBSURFACE DRAINAGE. COST OF FURNISHING AND INSTALLING THE FILTER CLOTH WILL BE CONSIDERED COMPLETELY COVERED BY THE CONTRACT UNIT PRICE FOR OTHER ITEMS.

FOR MORE DETAILS AND SECTION THROUGH BOX, SEE 703.11 SHEET 2 OF 3.

① UPSTREAM   = 3'-5"
   DOWNSTREAM = 4'-0"

② IF MORE THAN ONE TRANSVERSE JOINT IS REQUIRED, SEE STANDARD SHEET 703.12 FOR DETAILS.

③ FOR DETAILS AND REINFORCEMENT IN WINGS, SEE STANDARD SHEET 703.37.

④ USE THESE BARS FOR DESIGN FILLS OF MORE THAN 2'-0".

⑤ USE THESE BARS FOR DESIGN FILLS OF 2'-0" OR LESS.

(✱✱) VARIES – 12" MAXIMUM

(✱✱✱) USE TRANSVERSE JOINT WHEN BARREL IS OVER 80 FEET LONG BETWEEN HEADWALLS.

USE ADDITIONAL TRANSVERSE JOINTS TO PROVIDE 50 FEET MAXIMUM SPACING BETWEEN JOINTS.

DISTANCE BETWEEN INSIDE FACE OF HEADWALL AND TRANSVERSE JOINT SHALL NOT BE LESS THAN 3'-0".

(✱✱✱✱) J4 BAR SPACING

MISSOURI HIGHWAY AND TRANSPORTATION COMMISSION

CONCRETE
SINGLE BOX STRUCTURE
FLARED WINGS
(SQUARE)

DATE: _____

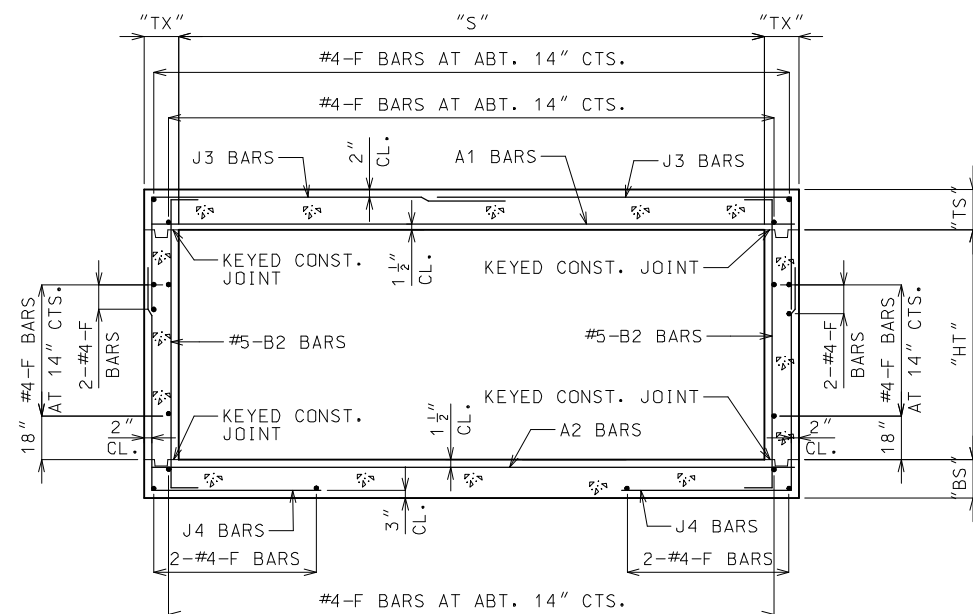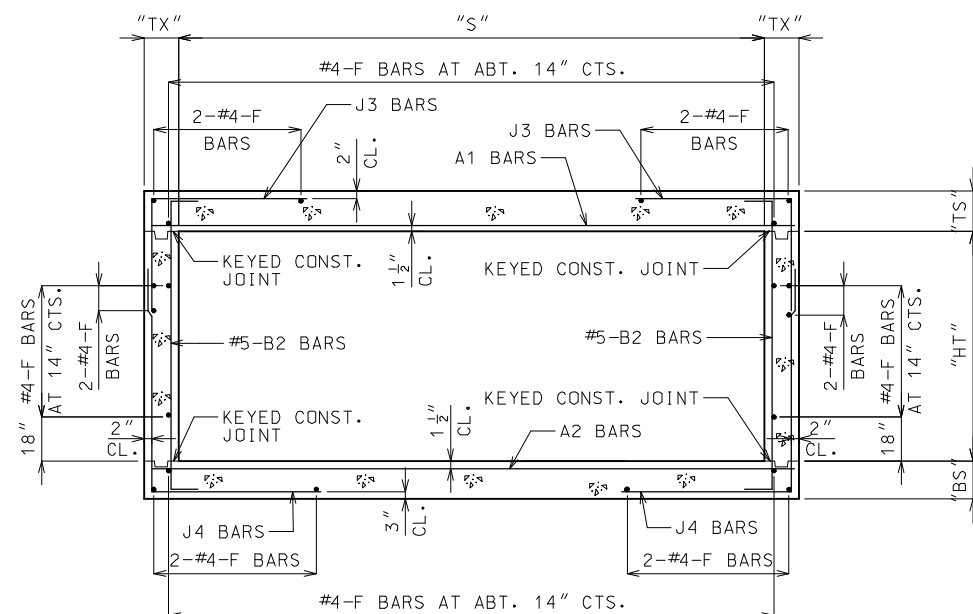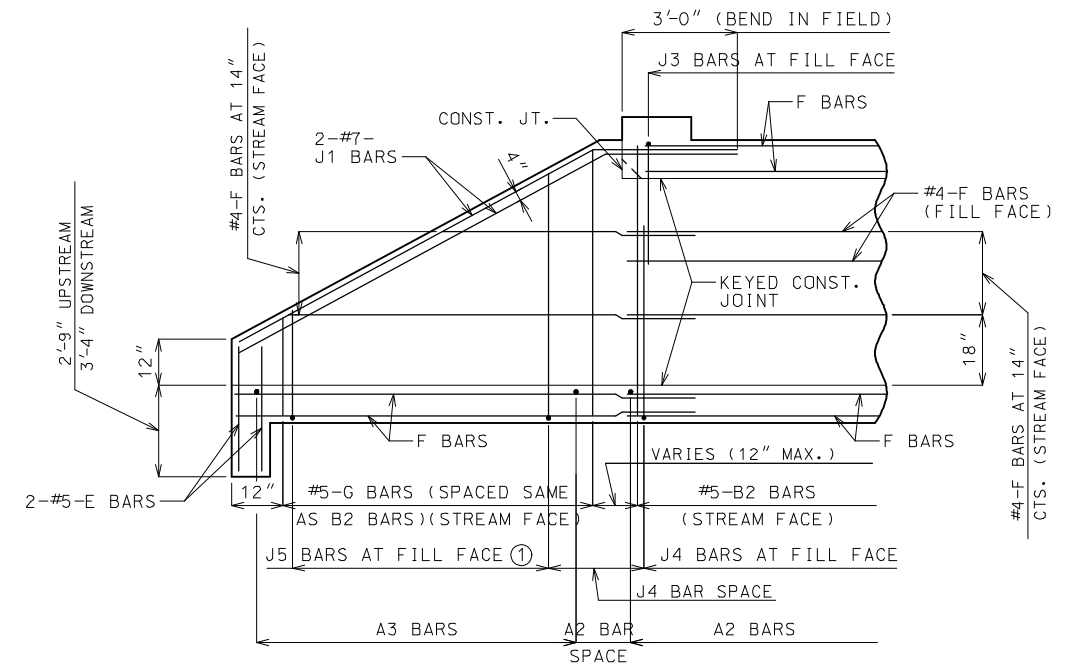EFFECTIVE: 09-01-2006

703.11G

1 / 3

SECTION THRU WINGS (UPSTREAM SHOWN)

SECTION THRU BOX (DESIGN FILLS 2'-0" OR LESS)

SECTION THRU BOX (DESIGN FILLS OVER 2'-0")

ELEVATION OF WING
(UPSTREAM SHOWN)

NOTE: CONSTRUCTION JOINT KEY OMITTED FOR CLARITY.

GENERAL NOTES:

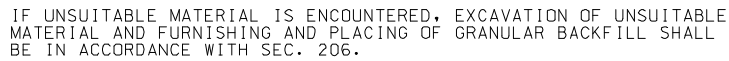ALL DIMENSIONS SHOWN ARE IN INCH UNLESS OTHERWISE NOTED.

J1 BARS MAY BE BENT IN FIELD OR SHOP.

MINIMUM CLEARANCE TO REINFORCING STEEL SHALL BE 1-1/2"
UNLESS OTHERWISE SHOWN.

FOR DIMENSIONS AND SIZE AND SPACING OF REINFORCING STEEL,
SEE STANDARD SHEET 703.15.

① FOR DETAILS OF REINFORCEMENT IN WINGS, SEE STANDARD
SHEET 703.37.

ELEVATION A-A
(NORMAL TO ₵ ROADWAY)

₵ ROADWAY & ₵ MEDIAN →
SHOULDER TO SHOULDER WIDTH
(AS SHOWN ON ROAD SECTION)

FILL AT ₵ RDWY.

BETA

ALPHA

CONST. JT.

FLOW

"HT"

"TS"

"BS"

2'-9"

12" (TYP.)

3'-4"

10" (TYP.)

3"

20"

6"

6"

20°

GRANULAR BACKFILL

NOTE: SLOPE OF BOTTOM SLAB SHALL BE
PLACED AT NATURAL STREAM GRADIENT.

IF UNSUITABLE MATERIAL IS ENCOUNTERED, EXCAVATION OF UNSUITABLE
MATERIAL AND FURNISHING AND PLACING OF GRANULAR BACKFILL SHALL
BE IN ACCORDANCE WITH SEC. 206.

SECTION THRU BOX
(NORMAL TO ₵ STRUCTURE)

"TX"   "S"   "TX"

"TS"

"HT"

"BS"

18" (TYP.)

GRANULAR BACKFILL

GENERAL DATA TABLE

VARIABLE	DIMENSION (in.)
ALPHA	SEE EQUATIONS
BETA	SEE EQUATIONS
"B"	SEE EQUATIONS
"C"	SEE EQUATIONS
"D"	R + M + N + 20"
"E"	G + 23"
"F"	S + 2TX
"G"	2V
"L"	2A + B + C + D + E
"M"	N(COS 20°)
"N"	3" + TX(TAN 10°)
"P"	2V(SEC 20°)
"Q"	TX(COS 20°)
"R"	P(COS 20°)
"U"	(R + M)(TAN 20°)
"V"	HT + TS - 12"
"Y"	TX(SIN 20°)
"KK"	S/2 + U

GENERAL NOTES:

DESIGN SPECIFICATIONS:
AASHTO - 2002
LOAD FACTOR DESIGN

DESIGN UNIT STRESSES:
CLASS B-1 CONCRETE f'c = 4,000 psi
REINFORCING STEEL (GRADE 60),
fy = 60,000 psi

DESIGN LOADING:
EARTH 120 #/ft.³
EQUIVALENT FLUID PRESSURE
30 #/ft.³ (MIN.) - 60 #/ft.³ (MAX.)

ALL DIMENSIONS SHOWN ARE IN INCHES
(in.) UNLESS OTHERWISE NOTED.

THIS DRAWING IS NOT TO SCALE.
FOLLOW DIMENSIONS.

FOR DIMENSIONS NOT SHOWN, SEE
STANDARD SHEETS 703.11, SHEETS
1 & 2 OF 3 OR 703.15.

NOTE:
WHEN ALTERNATE PRECAST BOX SECTIONS ARE USED, THE MINIMUM BARREL
LENGTH MEASURED ALONG THE SHORTEST WALL FROM THE FIRST JOINT TO
THE OUTSIDE OF THE HEADWALL SHALL BE 3'-2". REINFORCEMENT AND
DIMENSIONS FOR THE WINGS AND HEADWALLS SHALL BE IN ACCORDANCE WITH
MISSOURI STANDARD PLANS DRAWINGS.

DETAIL "A"

"TX"

CONST. JT.

3"   3"

10°   10°

20"

DETAIL "B"

"TX"

CONST. JT.

3"   1"

20"

"TX"

PLAN SHOWING LAYOUT DIMENSIONS

FLOW

"KK"   "Q"

"U"

"TX"

A

10"

20°

"R"

"P"

3"

3"

CONST. JT. (TYP.)

DETAIL "A"

"D"

"A"+"B"

"A"+"C"

"E"

"TX"   "S"   "TX"

₵ STATION

₵ ROADWAY OR
₵ MEDIAN

"F"

18"   20"   18"

"G"

10"

3"

DETAIL "B"

₵ STRUCTURE →   A

INSIDE TO INSIDE OF HEADWALLS

LIMITS OF GRANULAR BACKFILL

"L" = TOTAL LENGTH ALONG ₵ STRUCTURE

EQUATIONS FOR COMPUTING
LENGTH OF BARRELS

LET ALPHA = ANGLE OF SLOPE OF BARREL WITH HORIZONTAL ALONG
₵ OF CULVERT.

LET BETA = ANGLE OF SLOPE OF FILL NORMAL TO ₵ ROADWAY.

$$\text{"B" OR "C"} = \frac{(FILL\ AT\ ₵\ ROADWAY) \pm (CROSS\text{-}SLOPE)\ X\ \text{"A"}}{TAN(BETA)\ \pm\ TAN(ALPHA)} \pm A\ TAN(ALPHA)$$

"B" OR "C" = HORIZONTAL DISTANCE FROM EDGE OF SHOULDER TO
HEADWALL NORMAL TO ₵ OF ROADWAY.

DEFINITIONS

CROSS-SLOPE: SLOPE OF EACH PART OF THE ROADWAY INCLUDING
ROADWAY CROWN, SHOULDER SLOPE, AND/OR SUPERELEVATION.
SEE DESIGN ROADWAY CROSS SECTION FOR LANE AND SHOULDER
WIDTHS AND SLOPES.